WHAT IS CLAIMED IS:

1. A permanent magnet having a ferromagnetic phase and a grain boundary phase, wherein the ferromagnetic phase is matched with the grain boundary phase.

2. The permanent magnet as defined in claim 1 wherein atoms are arrayed regularly on both sides of an interface between the ferromagnetic phase and the grain boundary phase.

3. The permanent magnet as defined in claim 1 wherein said grain boundary phase has a crystal type, plane index and azimuthal index matched to said ferromagnetic phase.

4. The permanent magnet as defined in claim 1 wherein a magnetocrystalline anisotropy at a lattice point of said ferromagnetic phase neighboring to an interface with said grain boundary phase is not less than one-half a magnetocrystalline anisotropy at a lattice point interior of said ferromagnetic phase.

5. A permanent magnet wherein an outermost shell of ferromagnetic grains has a magnetocrystalline anisotropy not less than one-half a magnetocrystalline anisotropy interior of the ferromagnetic grains.

6. The permanent magnet as defined in claim 5 wherein the magnetocrystalline anisotropy in the outermost shell of the ferromagnetic grains is higher than a magnetocrystalline anisotropy interior of the

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ferromagnetic grains.

7. The permanent magnet as defined in claim 6 wherein the magnetocrystalline anisotropy within five atomic layers from the outermost shell of the ferromagnetic grains is higher than the magnetocrystalline anisotropy interior of the ferromagnetic grains.

8. A permanent magnet comprising ferromagnetic grains displaying magnetocrystalline anisotropy mainly by crystal fields from rare earth metals, and a grain boundary phase, wherein

cations are located in an extending direction of 4f electron cloud of rare earth element ions in said grain boundary phase neighboring to the rare earth element ions located at an outermost shell of said ferromagnetic grains.

9. The permanent magnet as defined in claim 8 wherein a source of said cations is one or more selected from the group consisting of Be, Mg, Al, Si, P, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Sr, Zr, Nb, Mo, Cd, In, Sn, Ba, Hf, Ta, Ir and Pb.

10. A method for producing a permanent magnet comprising:

adding a cationic source to ferromagnetic grains exhibiting magnetocrystalline anisotropy mainly by crystal fields of rare earth elements; and

precipitating a crystal containing said cationic

source at least in a grain boundary phase portion neighboring to said ferromagnetic grains and locating cations in an extending direction of 4f electron cloud of rare earth element ions located at an outermost shell of said ferromagnetic grains.

11. A method for designing permanent magnets comprising setting a composition of a grain boundary phase, and a crystal type, plane index and an azimuthal index of the grain boundary phase in the state of co-existence of both a ferromagnetic phase and the grain boundary phase, depending on a crystal structure of the ferromagnetic phase, so that the ferromagnetic phase will be matched with said grain boundary phase.

12. An R-TM-B based permanent magnet containing a magnetic phase mainly composed of a $R_2TM_{14}B$ intermetallic compound having a crystal structure of a tetragonal system, where R is a rare earth element including Y and TM is a transition metal, and a grain boundary phase, mainly composed of an R-TM alloy,

wherein the crystal structure of said grain boundary phase in the vicinity of an interface between the magnetic phase and the grain boundary phase is a face-centered cubic structure, and

wherein the grain boundary phase is matched with the magnetic phase.

13. The R-TM-B based permanent magnet as defined in

claim 12 wherein, in said $R_2TM_{14}B$ intermetallic compound, the sum of Nd and/or Pr in R is not less than 50 at% and wherein TM is Fe and/or Co, with Fe in TM being at least 50 at%; and

R in said R-TM alloy being not less than 90 at%.

14. The permanent magnet as defined in claim 12 wherein the crystallographic orientation in the vicinity of the interface between the magnetic phase and the grain boundary phase is represented by at least a set of expressions (A) to (C):

(001) magnetic phase // (110) grain boundary phase and [110] magnetic phase // [001] grain boundary phase...(A)

(001) magnetic phase // (221) grain boundary phase and [110] magnetic phase // $[11\bar{1}]$ grain boundary phase...(B)

(001) magnetic phase // (111) grain boundary phase and [100] magnetic phase // $[1\bar{1}0]$ grain boundary phase...(C)

wherein the angle of deviation in the crystallographic orientation is not larger than 5° .

15. The permanent magnet as defined in claim 1 wherein

R is 8 to 30 at% ;

B is 2 to 40 at% ; with

the balance mainly being Fe.

16. An R-TM-B based permanent magnet containing a

magnetic phase of a tetragonal crystal structure and a grain boundary phase having a face-centered cubic structure as a crystal structure in the vicinity of an interface to said magnetic phase, said magnetic phase matching with said grain boundary phase interposing said interface.

17. A method for manufacturing an R-TM-B based permanent magnet comprising:

employing a source of an $R_2TM_{14}B$ intermetallic compound exhibiting ferromagnetic properties (R: rare earth element embracing Y; TM: transition metal) and an R-TM alloy source, as a starting material;

precipitating an $R_2TM_{14}B$ tetragonal crystal phase and precipitating the R-TM face-centered cubic phase around said $R_2TM_{14}B$ tetragonal crystal phase for matching said $R_2TM_{14}B$ tetragonal crystal phase and said R-TM face-centered cubic phase to elevate magnetocrystalline anisotropy of said $R_2TM_{14}B$ tetragonal crystal phase in the vicinity of an epitaxial interface.

18. An R-TM-B based permanent magnet composed of magnetic phase mainly made up of an $R_2TM_{14}B$ intermetallic compound having a tetragonal crystal structure (R: rare earth element embracing Y; TM: transition metal) and a grain boundary phase mainly made up of an R_3TM alloy, wherein

the crystal structure in the vicinity of an interface between the magnetic phase and the grain boundary phase is of a rhombic system and wherein the magnetic phase is matched with the grain boundary phase.

19. The R-TM-B based permanent magnet as defined in claim 18 wherein, in said $R_2TM_{14}B$ intermetallic compound, the sum of Nd and/or Pr in R is not less than 50 at% and wherein TM is Fe and/or Co, with Fe in TM being not less than 50 at%.

20. The R-TM-B based permanent magnet as defined in claim 18 wherein, in said $R_2TM_{14}B$ intermetallic compound, Fe in TM accounts for not less than 50 at% and Co in TM is not less than 0.1 at%; and wherein

in said R_3TM intermetallic compound, Co in TM is not less than 90 at%.

21. The permanent magnet as defined in claim 18 wherein the crystallographic orientation in the vicinity of an interface between the magnetic phase and the grain boundary phase is represented by at least a set of expressions (F) to (I):

(001) magnetic phase // (001) grain boundary phase and [110] magnetic phase // [110]grain boundary phase...(F)

(001) magnetic phase // (110) grain boundary phase and [110] magnetic phase // [001] grain boundary

phase ...(G)

(001) magnetic phase // (221) grain boundary phase and [110] magnetic phase // $[11\bar{1}]$ grain boundary phase...(H)

(001) magnetic phase // (111) grain boundary phase and [100] magnetic phase // $[1\bar{1}0]$ grain boundary phase...(I)

wherein the angle of deviation in the crystallographic orientation is not larger than 5° .

22. The permanent magnet as defined in claim 18 wherein

R is 8 to 30 at% ;

B is 2 to 40 at% ;

Fe is 40 to 90 at% ; and

Co is 50 at % or less.

23. An R-TM-B based permanent magnet containing a magnetic phase having a tetragonal crystal structure and a grain boundary phase having a rhombic crystal structure in the vicinity of an interface to said magnetic phase, said grain boundary phase matching with said magnetic phase interposing said interface.

24. A method for manufacturing an R-TM-B based permanent magnet comprising:

employing a source of an $R_2TM_{14}B$ intermetallic compound exhibiting ferromagnetic properties (R: rare earth element embracing Y; TM: transition metal) and an R_3TM alloy source, as a starting material; and

precipitating an $R_2TM_{14}B$ tetragonal crystal phase and precipitating an R_3TM rhombic phase around said $R_2TM_{14}B$ tetragonal crystal phase to match said R_3TM rhombic phase to said $R_2TM_{14}B$ tetragonal crystal phase to elevate magnetocrystalline anisotropy of said $R_2TM_{14}B$ tetragonal crystal phase in the vicinity of an epitaxial interface.

25. An R-TM-B based permanent magnet comprising:

a magnetic phase mainly containing an $R_2TM_{14}B$ intermetallic compound having a tetragonal crystal structure (R: rare earth element embracing Y; TM: transition metal) and a grain boundary phase containing an R-TM-O compound,

wherein the crystal structure of the grain boundary phase in the vicinity of an interface between the magnetic phase and the grain boundary phase is of a face-centered cubic structure, and

wherein the grain boundary phase is matched to the magnetic phase.

26. The R-TM-B based permanent magnet as defined in claim 25 wherein said R-TM-O compound having the face-centered cubic structure is precipitated in the vicinity of the interface within the grain boundary phase.

27. The R-TM-B based permanent magnet as defined in claim 25 wherein, in said $R_2TM_{14}B$ intermetallic compound,

the sum of Nd and/or Pr in R is not less than 50 at%, TM is Fe and/or Co, and Fe in TM is not less than 50at% and

wherein in said R-TM-O compound, the ratio of R to the sum of R and TM is not less than 90 at%, the ratio of O is not less than 1 at% and not larger than 70 at%.

28. The R-TM-B based permanent magnet as defined in claim 25 wherein the crystallographic orientation in the vicinity of an interface between the magnetic phase and the grain boundary phase is represented by at least a set of expressions (A) to (C):

(001)magnetic phase // (110)grain boundary phase and [110]magnetic phase // [001]grain boundary phase...(A)

(001)magnetic phase // (221)grain boundary phase and [110]magnetic phase // $[11\bar{1}]$grain boundary phase...(B)

(001)magnetic phase // (111)grain boundary phase and [100]magnetic phase // $[1\bar{1}0]$grain boundary phase...(C)

wherein the angle of deviation in the crystallographic orientation is not larger than 5° .

29. The permanent magnet as defined in claim 25 wherein

R is 8 to 30 at% ;

B is 2 to 40 at% ; with

the balance mainly being TM.

30. An R-TM-B based permanent magnet containing a magnetic phase having a tetragonal crystal structure and a grain boundary phase in which there exists an oxygen-containing compound having a face-centered cubic structure in the vicinity of an interface to said magnetic phase,

said grain boundary phase matching with said magnetic phase interposing said interface.

31. A method for manufacturing an R-TM-B based permanent magnet comprising:

precipitating an $R_2TM_{14}B$ tetragonal crystal phase from an alloy containing R (R: rare earth element embracing Y), TM (TM: transition metal), B and O, and precipitating an R-TM-O face-centered cubic phase around said $R_2TM_{14}B$ tetragonal crystal phase to match said R-TM-O face-centered cubic phase and said $R_2TM_{14}B$ tetragonal crystal phase to elevate magnetocrystalline anisotropy of said $R_2TM_{14}B$ tetragonal crystal phase in the vicinity of an epitaxial interface.

32. Rare-earth magnetic powders for bonded magnets wherein at least one alkaline earth metal is present in an interface of an $R_2TM_{14}B$ phase (R: rare earth element embracing Y, and TM: transition metal) in a matched state relative to the $R_2TM_{14}B$ phase.

33. Rare-earth magnetic powders for bonded magnets as defined in claim 32 wherein said alkaline earth metal

having a range of the lattice constant a = 4.7 to 5.7 A (Angstrom) is present in said interface of the $R_2TM_{14}B$ phase.

34. Rare-earth magnetic powders for bonded magnets as defined in claim 32 wherein

the crystallographic orientation in the vicinity of an interface between the magnetic phase and a boundary phase diffused with said alkaline earth metal is represented by at least a set of expressions (A) to (E):

(001)major phase // (110)grain boundary phase and [110]major phase // [001]grain boundary phase...(A)

(001)major phase // (221)grain boundary phase and [110]major phase // [11$\bar{1}$]grain boundary phase...(B)

(001)major phase // (111)grain boundary phase and [100]major phase // [1$\bar{1}$0]grain boundary phase...(C)

(001)major phase // (201)grain boundary phase and [110]major phase // [010]grain boundary phase...(D)

(001)major phase // (2$\bar{2}$3)grain boundary phase and [110]major phase // [110]grain boundary phase...(E).

35. Rare-earth magnetic powders for bonded magnets as defined in claim 32 containing 0.5 to 5 parts by weight of alkaline earth metal per 100 parts by weight of $R_{2+x}TM_{14}B$ (R: rare earth element embracing Y, with $0 < x \leqq 0.3$, and TM: transition metal).

36. Rare-earth magnetic powders for bonded magnets wherein at least one alkaline earth metal is diffused in a grain boundary of polycrystalline grains of $R_2TM_{14}B$ (R: rare earth element including Y, and TM: transition metal) to matching with $R_2TM_{14}B$ crystals.

37. Rare-earth magnetic powders for bonded magnets comprised of alkaline earth metals impregnated in powders mainly composed of magnetic particles containing a $R_2TM_{14}B$ phase (R: rare earth element embracing Y and TM: transition metal), with a coercivity (iHc) being not less than 17 kOe.

38. A method for producing rare-earth element magnetic powders for bonded magnets comprising the steps of:

providing powders mainly composed of magnetic particles containing a $R_2TM_{14}B$ phase (R: rare earth element embracing Y and TM: transition metal), and

impregnating said powders with at least one alkaline earth metal to raise the coercivity of said $R_2TM_{14}B$ phase.

39. The method for producing rare-earth magnetic powders for bonded magnets as defined in claim 38 further comprising:

pulverizing a $R_{2+x}Fe_{14}B$ alloy ($0 < x \leq 0.3$) to give said magnetic particles containing an $R_2TM_{14}B$ phase (R: rare earth element embracing Y, and TM: transition metal).

40. The method for producing rare-earth magnetic powders for bonded magnets as defined in claim 38 wherein 0.5 to 7 parts by weight of said alkaline earth metal is impregnated in 100 parts by weight of magnetic particles containing $R_2TM_{14}B$ (R: rare earth element embracing Y, and TM: transition metal).

41. A method for producing rare-earth magnetic powders for bonded magnets comprising the steps of:

adding at least one alkaline earth metal to powders mainly composed of magnetic particles containing a $R_2TM_{14}B$ phase (R: rare earth element embracing Y, and TM: transition metal),

mixing the added mass; and

heat-treating the resulting mass at a temperature lower than a melting point of said $R_2TM_{14}B$ phase to diffuse the alkaline earth metal along an interface of said $R_2TM_{14}B$ phase.

42. The method for producing rare-earth magnetic powders for bonded magnets as defined in claim 41 wherein the powders mainly composed of said magnetic particles are of a mean particle size ranging from 3 to 400 μm, and wherein said alkaline earth metal is of a mean particle size ranging from 0.5 to 3 mm.

43. A method for producing rare-earth magnetic powders for bonded magnets comprising the steps of:

depositing at least one alkaline earth metal on

the surface of magnetic particles containing an $R_2TM_{14}B$ phase (R: rare earth element embracing Y, and TM: transition metal), using a gaseous phase film-forming method; and

subsequently heat-treating the resulting mass at a temperature not higher than a melting point of said $R_2TM_{14}B$ phase.

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